WG4 - Light and heavy ions

IR2@EIC 1st workshop
March 19, 2021

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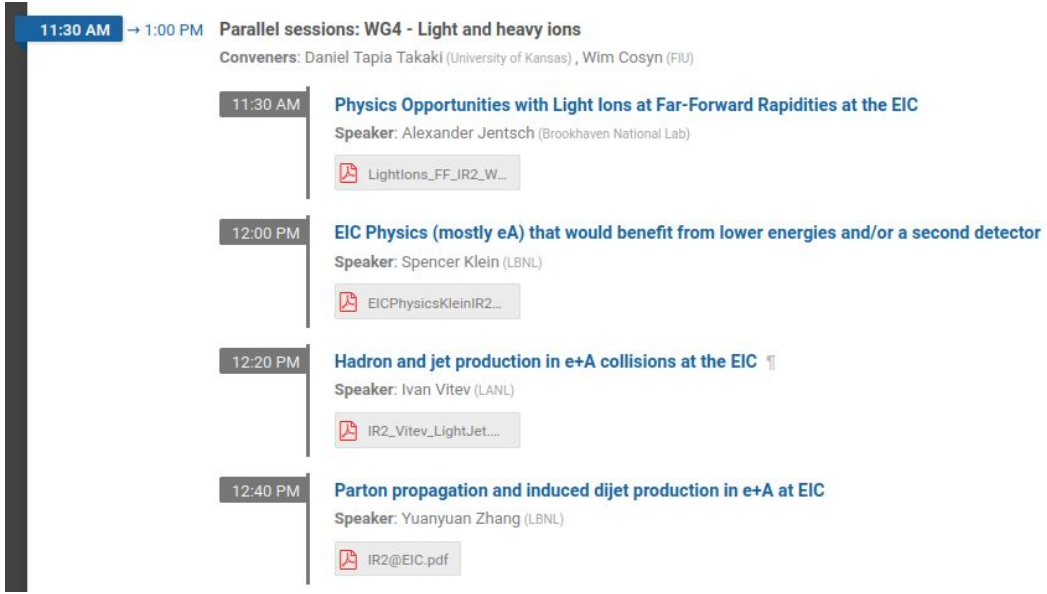
Thank you to all the speakers
and participants in the session



In this talk, we will focus on questions / issues raised that can be addressed using an IR2
Feel free to add others after this talk!

Additionally:

- Nuclei were mentioned in talks in other WGs
- Plenary talks by I. Cloët, C. Weiss & Y. Furletova highlighted some of this too

A. Jentsch - Light ions at far forward rapidities

- Common across diff. Processes w light ions: detecting final-state nucleons in the far-forward region
- Design uniquely challenging due to machine constraints

- Roman pots: optics change with E, but also tradeoff between lumi and p_T acceptance at fixed E

e+p Beam Energy	Option 1 (high luminosity)	Option 2 (high acceptance)
18x275 GeV	pT > 0.35 GeV/c	pT > 0.2 GeV/c
10x100 GeV	pT > 0.2 GeV/c	pT > 0.1 GeV/c (or better)
5x41 GeV	pT > 0.1 GeV/c	N/A

Option 1: higher lumi., **larger beam at RP** **Option 2:** lower lumi., **smaller beam at RP**

- B0: potential inclusion of EMCal or preshower detector [photons from incoherent breakup]
- Off momentum: acceptance loss of particles in quadrupoles
- ZDC: acceptance limited by bore of magnet → $0 < \theta < 4.5$ mrad in IR1 [improve?]

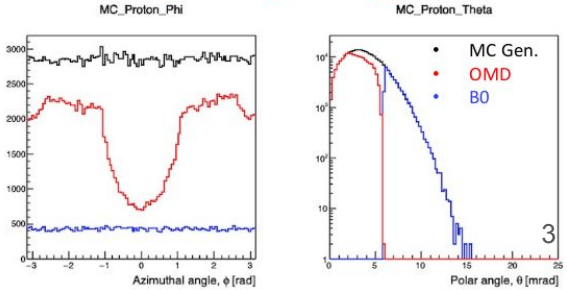
Thoughts on IR2 [all under study → V. Mozorov]:

- Desire for more acceptance
- Secondary focus at RP [low p_T, coherent light ions]
- Altered beam bending [ZDC]
- Move gap between OMD/B0 in IR2

- Ongoing process, interplay with IP6 development/simulations

e+d -> J/Psi + p + n (18x110GeV)

Neutron spectator/leading proton case.

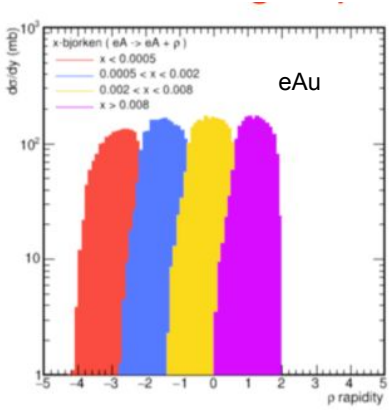


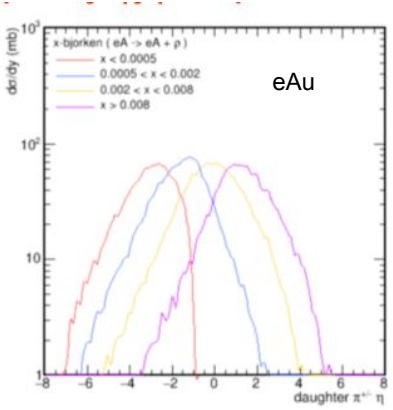
S. Klein - EIC Physics (mostly eA) that would benefit from lower energies and/or a second detector

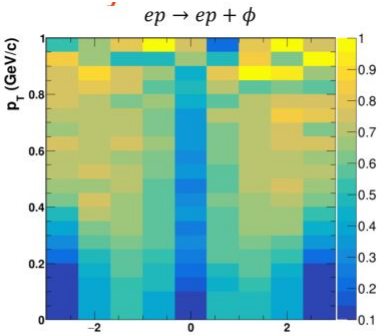
- **Photo**production of ρ/ϕ to study shadowing
- Reference detector cuts out a low/high-x region
- $\phi \rightarrow K^+K^-$ has reduced efficiency issues at large |y|, y=0
- Coh/incoh VM prod. separation: photons from nuclear decay E<100 MeV
- Diffractive dips

$P_{T,VM} = P_{T,Pomeron} \oplus P_{T,photon} \oplus$ Resolution

- Need photon p_T to accurately determine Pomeron p_T
  - Observe scattered electron down to low Q^2
    - Limited by beam emittance; easier at higher k/E_e

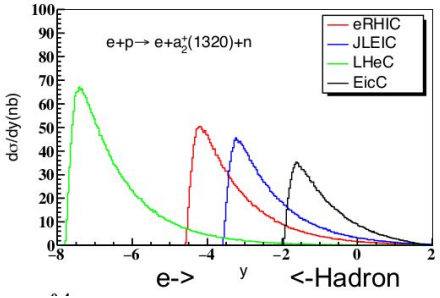






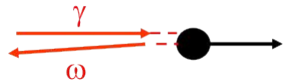
ϕ detection efficiency in an all-silicon tracker

S. Klein - EIC Physics (mostly eA) that would benefit from lower energies and/or a second detector



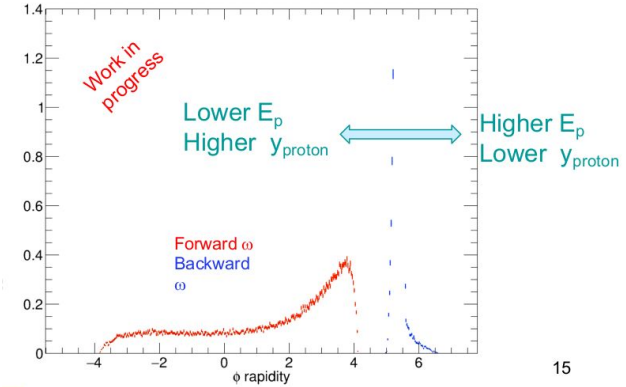
- a_2^+, Z_c^+ require good ion-going acceptance, might be easier at lower E
  Forward region shifted to mid-rap

- Backward production (baryon exchange traj)



  - Proton easy
  - Forward VM tough, $\omega \rightarrow \pi^0\gamma$ promising (calometric)
    Lower E_p seems better

- Instrument the IR above & below the plane where the beams diverge



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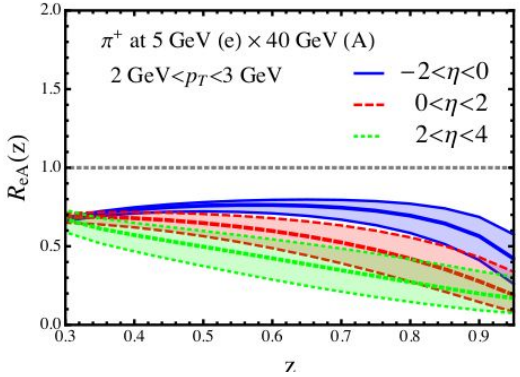
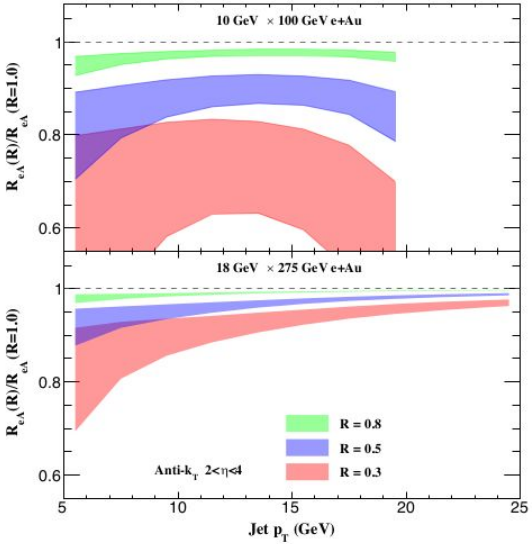
I. Vitev - Hadron and jet production in eA collisions

- In medium parton splitting, NLO
- Light hadrons: Transport properties constrained w HERMES data
- In medium energy loss: **Pions** show largest suppression, largest at low CM



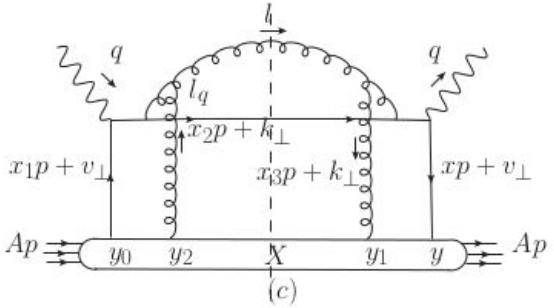
- Jets: interplay of IS (EMC) and FS effects (E-loss)
  → double ratios: effects larger for lower CM, small jet radius
- Jet cross section modifications are related to substructure mo
  → Jet charge at EIC

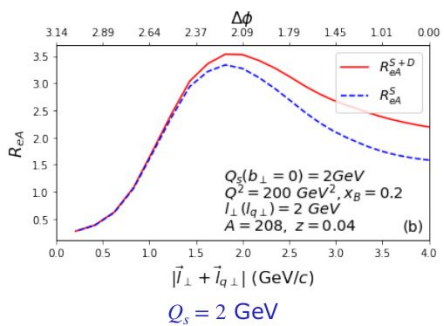


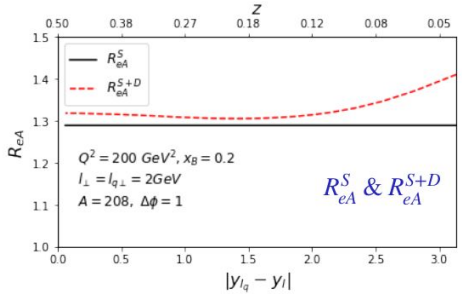
- To study the physics of hadronization, particle propagation in matter lower CM energies, forward rapidity and high luminosity are very beneficial

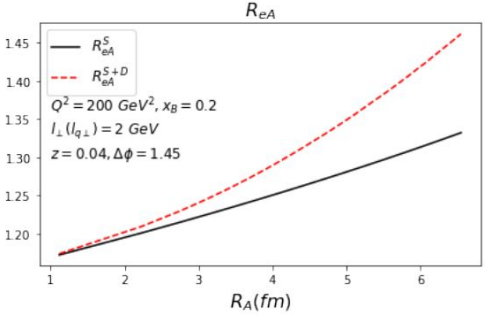
Y-Y Zhang - Parton Propagation and Induced Dijet Production

- $\hat{q}$ in cold matter through DIS (avg sq p_T broadening per unit length)
- Dijet production with **S**ingle and **D**ouble parton scattering included
- Gluon TMD in medium enters in $\hat{q}$ (gluon saturation included)
- e+Au 10x100 GeV, x_B=0.2
- Unique features in nuclear modification ratio R_{eA}









Additional remarks

- It's clear many parts of the eA program can benefit from the 2nd IR
- Optimizing far forward region with complementarity in mind is important in that regard
- Importance of full-simulations of studies
- Many things left to explore…